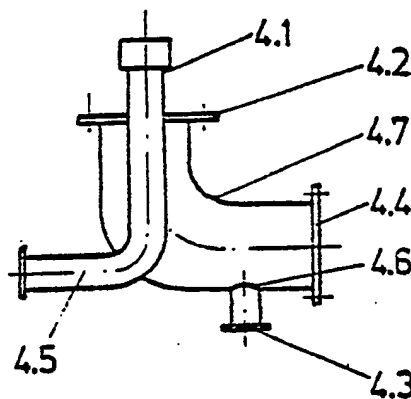
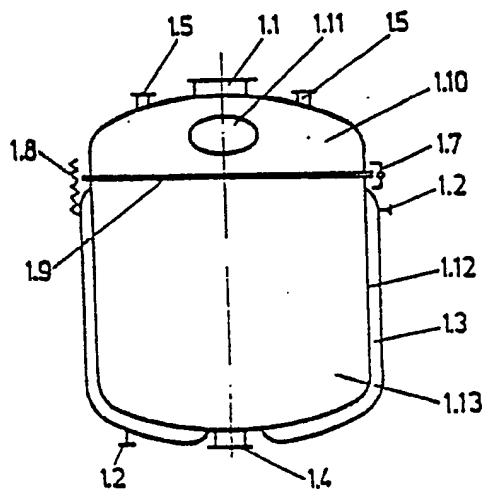




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(54) Title: MULTI-PURPOSE CHEMICAL INDUSTRIAL APPARATUS



## (57) Abstract

The multi-purpose chemical industrial apparatus according to the invention, particularly for carrying out different processes of pharmaceutical technologies, -which has preferably a double-walled basic apparatus assembled from cup and connected aponable dome cover, the basic apparatus having a part for admission of the material to be processed, e.g. one or several intake stub(s) arranged on the dome cover, a part for removal of the material, e.g. discharge stub arranged on the cup, and devices suitable for a given case for temperature variation of the material- formed in such a way that the basic apparatus is connected with at least one washing unit and filter unit, as well as a combined attachment unit connectible to the discharge stub of the cup of the basic apparatus. Further criterion of the multi-purpose chemical industrial apparatus according to the invention is that the cup of the basic apparatus has a heater stub connectible to heat source, e.g. heat exchanger, and the heater stub is led into the jacket space between the double wall of the cup.

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MULTI-PURPOSE CHEMICAL INDUSTRIAL APPARATUS

The invention relates to multi-purpose chemical industrial apparatus, particularly for different processes of the pharmaceutical technologies. It is preferably a double-walled basic apparatus assembled from a cup and from the adjoining openable dome cover. The basic apparatus has one or several intake stub/s/ arranged on the dome cover for admission of the material to be processed, an outlet stub arranged on the cup for discharge of the material and in given case devices suitable for varying the temperature of the material.

Certain process combined with filtering is a frequent task in the chemical, especially in the pharmaceutical technologies.

For this reason most of the known multi-purpose apparatuses are suitable for incorporating some kind of filter material or filter device. Such mixing device also exists, where the lower part has a filter material through which the liquid passes, while the filtered solid particles remain on the top of the filter material. The filtered, so-called "cake" is loosened by the mixer units of the machine and possibly dried with the heatable



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jacket of the apparatus.

There are such multi-purpose apparatuses at which the drying is accelerated with vacuum. These apparatuses can be equally used for "cake" filtering, drying, reaction and for heat transfer facilitating the efficiency. Deficiency of such apparatuses is represented by having small filtering surface, thus they can not be used for separation of suspensions with large solid substance content, or for filtering viscous materials. Further development of the known apparatuses was aimed at such apparatus, which has larger filter surface. Further objective was the mechanization and automation of the part-processes.

As a result of the mentioned efforts, such technical solution was brought about, which is described in the GDR patent specification No. 110 776. The apparatus has a vertical driving shaft, its filter elements are similarly vertically arranged and rotated around the shaft. The apparatus is used first of all for purification by filtering. However mounting and dismounting of the filter insert are difficult, which means that the apparatus is not suitable for other process.

The liquid filter described in the Swiss



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patent specification No. 468 842 is built up according to a different principle. This has candle-shaped filter elements, which are rotated with a shaft, thus their surface can be cleaned. Use of the candles results in complicated structural build-up. The rotating mechanism composed of several parts and connected in a complicated way excludes the possibility of exchanging the filter inserts with other technological units suitable for carrying out other processes.

The Swiss patent specification No. 487 664 describes an apparatus having rotatable filter bags. The filter bags are fixed on a tubular shaft with the aid of which they are rotated. The solution is ingenious, because the tubular shaft is also suitable for conveyance of the filtrate. However the structural build-up is sensitive and complicated, for this reason the filter inserts can not be quickly and simply removed, whereby the apparatus is not suitable for other, than filtering process.

With further development of the known basic idea an apparatus was brought about described in the Hungarian patent specification No. 160 608.



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The apparatus is formed by a horizontal cylindrical jacket with circular segment-shaped vertical filter bags arranged in the interior. Sludge flushing tube passes through in the centre of the filter plates along the centreline of the cylinder, which performs axial and concentric motion. The water flowing through the nozzles cleans the filter bags. Unfortunately the horizontal arrangement of the apparatus and its complicated rotating mechanism do not allow simple conversion and multi-purpose useage.

In the vertically arranged housing of the apparatus described in the GFR patent specification No. 1 461 400, circular filter elements are built in. It has a flushing unit, but this is vertically arranged and the filters are rotatable. As a result of rotation the filtered cake can be removed. The horizontally arranged apparatus makes the multi-purpose useage difficult. In addition, the mechanism is too complicated for making the apparatus variable.

Another developed solution is represented by the apparatus described in the GFR patent specification No. 1 461 487. Its advantage is its vertical arrangement, where the material to be



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filtered is admitted at the top, while separate discharge of the settled heavy phase and filtrate is possible at the bottom. The apparatus enables the simultaneous settling and filtering. However the apparatus is less suitable for carrying out any other other task. Thus for instance in case of the so-called purification filtering the purifying agents can not segregate on the surface of the filter, and they can not be utilized this way.

The invention is aimed at the development of such chemical-industrial apparatus, in which solid, liquid and gaseous materials can be mixed, separated, their temperature varied in such a manner, that a single basic apparatus should be supplemented with the devices most suitable for carrying out the actual task.

The objective includes that - owing to the fast product alternation - it should not be necessary to exchange the apparatuses for carrying out the different technological steps.

The purpose of the invention is to realize such apparatus, which has only easily exchangeable elements or units without essential alteration of the basic apparatus, it should be suitable



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for purification by filtering, cake filtering, gas purification, absorption, drying, intermittent or continuous reaction, crystallization, gas washing, emulsion-separation, solvent extraction and in given case for heat transfer, or heat extraction during any process.

In accordance with the objective the multi-purpose chemical industrial apparatus according to the invention, particularly for carrying out different processes of the pharmaceutical technologies, has preferably a double walled basic apparatus composed of a cup and adjoining openable dome cover, the basic apparatus has an intake part for admitting the material to be processed, e.g. one or several intake stub/s/ arranged on the dome cover, an outlet part for discharging the material, e.g. arranged as an outlet stub on the cup, and in given case it has devices suitable for temperature variation of the material, formed in such a way, that at least one washing unit and a filter unit are attached to the basic apparatus, as well as a combined attachment unit linked to the outlet stub of the cup.

Further criterion of the multi-purpose





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chemical-industrial apparatus according to the invention is, that the cup of the basic apparatus has a heater stub connected to heat source, e.g. heat exchanger, and the heater stub is led into the jacket space between the double wall of the cup.

The dome cover is seated on the cup along a connecting flange, while the lifting device and coacting hinge are between the cup and dome cover. The dome cover is provided with a stub suitable for connection of the washing unit, and in given case with a manhole allowing to reach into and/or admission into the apparatus space.

Mixing unit may be connected to the dome cover of the basic apparatus, which includes the motor-driven mixer shaft extending into the apparatus, and the mixing elements arranged at the end and formed in the shape of blades, furthermore a drive and/or coupling is built in between the driving motor and mixer shaft. The mixing unit is admitted into the apparatus space through the dome cover, e.g. through the cover stub or manhole.

The washing unit includes the revolving



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gear driven shaft extending into the apparatus and at least one spray pipe arranged on the shaft-end. The shaft passes through closed washing house, which has an inlet stub for admission of the washing liquid and a supporting flange fixed preferably to the cover stub. The spray pipe conforms to the character of the washing liquid and in given case it is provided with exchangeable nozzles.

The combined attachment unit includes a branching piece fixed to the cup of the basic apparatus and a connecting piece passing through the branching piece and reaching into the apparatus space. The branching piece has connecting devices of varying size for admission and discharge of materials with different consistency, e.g. one or several reduced stubs, and a stub with low resistance, etc.

A connecting flange suitable for connection with the outlet stub of the cup is formed on the upper part of the branching piece. The upper end of the connecting piece is provided with the devices e.g. filter unit arranged in the apparatus space.

The combined attachment unit is complemented



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with one or several level adjusting extension/s/ suitable for extracting the material from the zones at various levels of the apparatus space. The level adjusting extension includes the level adjusting tube, and the instant-connecting device fitting into the nest of the connecting piece arranged at the lower end of the level adjusting tube.

The filter unit is assembled from series of filter bags with large surface arranged in filter basket, while the filter bags are connected with the collecting pipe underneath. The filter bag is formed by a flat plate built into tubular frame, which has a network of preferably densely spaced channels on both sides leading into the tubular frame, while the filter bag is covered with exchangeable filter fabric conforming to the character of the material to be filtered.

The lower part of each filter bag has a connecting extension and the collecting pipe has nests suitable for receiving the connecting extensions. At a possible embodiment of the apparatus one, or several filter bag/s/ are omitted, and the receiving nests are closed with plug



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as substitute of the connecting extension at the place of the missing filter bags.

The collecting pipe is provided with an instant connecting device for draining fitted to the instant connecting nest of the combined attachment unit. Supporting pieces in frictional contact with the inside wall of the cup are arranged on the outside of the filter bag.

At a possible embodiment of the apparatus a mixer apparatus is assembled from the basic apparatus and mixing unit, in another case a phase-separator unit is formed from the combined attachment unit and level adjusting extension, while the combination of the mixer apparatus and phase separator in given case gives a solvent extracting apparatus. In case of another embodiment emulsion separating apparatus is assembled from the basic apparatus and phase separator unit, or a gas washing apparatus from the basic apparatus, washing unit and combined attachment unit.

At a further embodiment filter - washing apparatus is assembled from the basic apparatus, washing unit, ~~XXXXXX~~ combined attachment unit and filter unit, or



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gas filtering purifying filter, cake filter, drier or adsorber apparatus is assembled from the basic apparatus, washing unit, combined attachment unit and in given case from the filter unit fitted with plug at the place of one or several filter bag/s/.

The multi-purpose chemical industrial apparatus according to the invention has several technical and economic advantages. Its advantages are prominent particularly in the pharmaceutical industry, since the frequent product changes involve the frequent alteration of the technologies. The apparatus according to the invention does not require the keeping of several different apparatuses at the ready to carry out many different processes.

In the plant equipped with the multi-purpose apparatus, the technology can be quickly changed by the fast and simple reassembly of the apparatuses. The possibility is given for the assembly of an apparatus type for carrying out a given task, which is best suited to the characteristic properties of the materials to be processed.

The economic advantages are found first of all in the fact, that the reassembly of complete



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plant parts is not necessary when the technologies are changed and the target apparatus does not have to be substituted with other target apparatuses. As a result, various types of products can be produced in the plants within a shorter time, than with the earlier apparatuses.

The invention idea is based on the fact, that the apparatuses for carrying out characteristic tasks were generally suitable only for execution of a single chemical industrial process. Whereas there are multi-purpose apparatuses, but their capacity, qualitative parameters of the work performance lag far behind those of the target apparatuses.

The essence of the recognition is that by retaining the basic principle of the multi-purpose apparatuses, the possibility is given to bring about an apparatus from the properly selected assembly units, which are suitable to carry out any of the most frequently occurring chemical industrial processes with high capacity and with excellent qualitative indices. This allows the assembly of the multi-purpose apparatus from exchangeable and connectible units as a construction set. The set of devices shall contain



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in any case a mixing unit, washing unit, filter unit and combined attachment unit.

The invention is described by way of examples with the aid of drawings, in which:

Figure 1.: Basic apparatus

Figure 2.: Mixing unit

Figure 3: Washing unit

Figure 4.: Combined attachment unit

Figure 5.: Level adjusting extension

Figure 6.: Filter unit

Figure 7.: Filter bag and its connection

Figure 8.: Mixer apparatus assembled from the basic apparatus and mixing unit

Figure 9.: Extracting apparatus assembled from the basic apparatus, mixing unit, combined attachment unit and level adjusting extension

Figure 10: Emulsion separator assembled from the basic apparatus, combined attachment unit and level adjusting extension

Figure 11: Gas washing apparatus assembled from the basic apparatus, washing unit and combined attachment unit

Figure 12: Alternative of the units according to Figure 11., supplemented with



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filter unit as gas purifier, with other  
supplementary units

Figure 13.: Purifying filter

Figure 14.: Cake filter

Figure 15.: Crystallizer apparatus

Figure 16.: Drying apparatus

Figure 17.: Adsorber apparatus

Figure 1 illustrates the basic apparatus 1. in schematic vertical section, assembled from two main parts, cup 1.12 and dome cover 1.10. Cup 1.12 is provided with one or several heater stub/s/ 1.2, through which connection with for instance heat exchanger can be realized in order to vary the heat content of the material arranged in the apparatus space 1.13.

The connecting flange 1.9 is on the upper part of cup 1.12, along which the dome cover 1.10 fits to the cup 1.12. The connecting flange 1.9 serves for fastening the hinge 1.7 and the co-acting lifting device 1.8. With the aid of this latter one the dome cover is lifted up and folded back.

In order to heat the cup 1.12, it is advisable to have double wall and the heating medium arriving through the heater stubs 1.2 is





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admitted into the jacket space 1.3 between the two walls. The double wall allows the transfer of the heat content of the heating medium to the apparatus space 1.13 without having contact with the material arranged therein.

The dome cover 1.10 can be provided with such manhole 1.11 which permits to reach into or in case of large sized basic apparatus to enter the apparatus space 1.13. The cover stub 1.1 is on the dome cover 1.10 which enables the connection to other units and one or several intake stub/s/ 1.5 is/are on the dome cover to admit materials into the apparatus space 1.13. Naturally it is necessary to provide the cup 1.12 with at least one outlet stub 1.4, through which the materials can be discharged from the apparatus space 1.13.

Figure 2 shows a mixing unit 2, the main structural parts of which are the mixing shaft 2.5 and the mixing elements 2.1 arranged at the bottom of the shaft. These latter ones may be formed as single mixing blades. In principle it is possible to arrange such mixing elements in the intermediate sections of the mixing shaft 2.5. The mixing shaft is rotated through a

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driving gear 2.3 and coupling 2.2 by a driving motor 2.4.

The actual washing part of the washing unit 3 shown in Figure 3. is represented by the spray pipe 3.4 provided with nozzles 3.6, which is kept in concentric rotation by the washing shaft 3.3. The washing shaft 3.3 is rotated by the revolving gear 3.1. The washing shaft 3.3 is conducted through the washing house 3.2 which has a supporting flange 3.7 connectible to the cover stub of basic apparatus 1, and a medium-intake stub 3.5 suitable for admission of the washing liquid. The washing unit 3 can be formed also in such a way, that it is actuated as a Segner's wheel by the reactive force of the washing liquid passing through the nozzles 3.6.

The combined attachment unit 4 is shown in Figure 4., the connecting flange 4.2 of which allows its fixing to the discharge stub 1.4 of the basic apparatus 1. The adjoining house 4.7 of the combined attachment unit 4 is provided with stubs 4.4 of low resistance, through which lumpy materials can be passed, furthermore with one or several reduced stub/s/ 4.3 through which the materials of thinner consistency or lower

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viscosity can pass out of the branching space 4.6 of the adjoining house 4.7.

The connecting piece. 4.5 passes through the branching space 4.6 of the adjoining house 4.7, on the top of which instant-connecting nest 4.1 is arranged. This enables fitting of the combined attachment unit 4 to the filter unit 6.

The combined attachment unit 4 can be complemented with the level adjusting extension 5 as shown in Figure 5. The instant connection device 5.2 is arranged on the lower end of the level adjusting tube 5.1, connectible similarly with the instant connecting nest 4.1. The connection is realized by simple compression in axial direction.

Figure 6 illustrates the filter unit 6 in assembled form, while Figure 7 shows the filter bag 6.2 separately and drawn to a larger scale than shown in Figure 6. The filter bags 6.2 are parallel plates, lined up vertically next to each other in the filter basket 6.1. Each filter bag 6.2 has a connecting extension 6.5 seated into the receiving nest 6.7 of the horizontal collecting pipe 6.3 arranged at the lower part of the filter basket 6.1. The



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connecting extension 6.6 is provided with neck 6.12. The instant connection device 6.4 is arranged in the centre of the collecting pipe 6.3, through which the filtrate passing into the collecting pipe can be drained.

For the lateral stabilization of the filter basket 6.1 in the basic apparatus 1, it is advisable to provide the filter basket 6.1 with supporting pieces 6.5 which bear up against the internal wall of cup 1.12. Each filter basket is formed as a simple flat plate and both surfaces have a dense network of channels 6.9. These channels lead into the tubular frame 6.10.

The flat plate forming the filter bag 6.2 is covered with filter fabric 6.8 to retain the impurities and in given case it is replaceable. The filtrate passes through the filter fabric first into the channels 6.9, then into the tubular frame 6.10, which carries it into the collecting pipe 6.3. If for some reason less filter bags are necessary, then one or several of them can be removed and replaced by plugs 6.11 in the receiving nests 6.7.

Figure 8 shows the mixer apparatus 12 assembled from the basic apparatus 1 and mixing unit 2.



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The parts of the mixing unit 2 reaching into the apparatus space 1.13 can be mounted either through the manhole 1.11 or by opening the dome cover 1.10. The mixing unit 2 is fixed by connecting the connecting flange 2.6 to the cover stub 1.1.

The mixer apparatus 12 can be coupled with the phase separator unit 45 assembled from the combined attachment unit 4 and level adjusting extension 5. This way the solvent extracting apparatus shown in Figure 9 is brought about. A connecting pipe is fitted to one of the intake stubs 1.5 of dome cover 1.10 and this is brought into connection with the washing liquid tank 22 and with the feeding tank 27. The extracting liquid is conducted from the washing liquid tank 22, while the material to be purified from the feeding tank 27 into the basic apparatus 1. The intensive contact of the washing liquid and material to be purified is ensured by the mixing unit 2. Under its influence the washing liquid dissolves the soluble components of the material to be purified. The new phases after resting can be discharged from the apparatus through the combined attachment unit 4. Draining of the



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light phase takes place through the connecting piece 4.5, while the heavier phase is drained through the reduced stub 4.3.

Simple emulsion separating apparatus 145 can be assembled as shown in Figure 10. The emulsion to be separated is admitted from tank 21 through the intake stub 1.15 of dome cover 1.10 similarly into the apparatus, assembled from the basic apparatus 1 and phase separator unit 45. This latter mixing can be realized in the form of autoclave, e.g. by use of the basic apparatus 1 and mixing unit 2. In this case the outlet stub 1.4 of the emulsion tank 21 is connected to the intake stub 1.5 of the emulsion separator apparatus 145. Some kind of regulating device 7.1 is built into the connecting pipe 7.

Assembly of the emulsion separator apparatus 145 is commenced with assembly of the phase separator unit 45 from the combined attachment unit 4 and level adjusting extension 5, then the connecting flange 4.2 is fastened to the outlet stub 1.4 of the basic apparatus 1. The emulsion in the emulsion separator apparatus 145 separates to emulsion phases after suitable resting time. Next the light phase is discharged through the



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connecting piece 45, and the heavy phase through the reduced stub 4.3.

Figure 11 illustrates the gas washing apparatus 134 assembled from the basic apparatus 1, washing unit 3 and combined attachment unit 4. The supporting flange 3.7 of the washing unit 3 is connected to the cover stub 1.1 of the dome cover 1.10 and fixed. The discharge stub 1.4 of cup 1.12 is fastened similarly as before to the connecting flange 4.2 of the combined attachment unit 4.

The gas to be purified is conducted through gas pipe 8 into the connecting piece 4.5 of the combined attachment unit 4 and then into the apparatus space 1.13 of cup 1.12. The gas is washed with washing liquid. For this purpose the circulating pipe 9 is connected to the reduced stub 4.3 of the combined attachment unit 4 and to the medium intake stub 3.5 of the washing unit 3.

With the aid of the circulating pump 20 built into the circulating pipe 9, the washing liquid is passed off through the combined attachment unit 4, then returned into the washing unit and then into the apparatus space 1.13 of the basic apparatus 1. For the quantitative control of the



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washing liquid an adjustable shut-off device 9.1 e.g. valve is built into the circulating pipe 9.

For removal of the gas purified in the gas washing apparatus 134, a drain pipe 10 is used into which a shut-off device 10.1 suitable for the quantitative control can be built in. Naturally the circulating pump 20 is connected into the circulating pipe 9 in such a way, that its suction side is connected to the combined attachment unit 4 and its pressure side to the washing unit 3.

The pressurized washing liquid flowing through the nozzles 3.6 of the washing unit 3 brings about a fine spray fog in the apparatus space 1.13 of cup 1.12, under the influence of which the undesirable components can be effectively removed from the gas to be purified. The gas arriving from underneath into the apparatus space 1.13 first bubbles through the washing liquid in the apparatus space 1.13, then through the gas space above, where it is purified in the spray fog of the washing liquid to the desired degree.

The gas purifier apparatus 1346 shown in Figure 12 is brought about by complementing the





former gas washing apparatus 134 with the filter unit 6. At the assembly first the basic apparatus 1 and combined attachment unit 4 are fitted to each other as already described earlier. Next - after opening the dome cover 1.10 - the filter unit 6 is placed into the apparatus space 1.13. During this process the instant connecting device 6.4 of the filter unit 6 is pressed into the instant connecting nest 4.1 of the combined attachment unit 4.

After closing the dome cover 1.10, the supporting flange 3.7 of the washing unit 3 is fastened with the cover stub 1.1. The impure gas is forwarded through the reduced stub 4.3 into the branching space 4.6 of the adjoining house 4.7, then from there to the apparatus space 1.13 of cup 1.12.

The pressurized gas returns through the filter fabric 6.8, channels 6.9, tubular frame 6.10 collecting pipe 6.3 and instant connecting device 6.4 of the filter unit 6 into the combined attachment unit 4, through the connecting piece 4.5 of which it passes off, while the impurity is retained by the filter fabric 6.8. Clogging of the filter fabric 6.8 pores is continuously eliminated by regeneration with the washing liquid.

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The washing liquid is admitted into the apparatus space 1.13 through the nozzles 3.6 of the washing unit 3, while the impure washing liquid is discharged from the apparatus space 1.13 through the drain pipe 11 provided suitably with shut-off device 11.1 connected to the low resistant stub 4.4 of the combined attachment unit 4. Thus the filter fabric 6.8 is cyclically regenerated.

Figure 13 shows the purifying filter 1346 assembled similarly as the previous unit. The material is passed from the mixer autoclave 21 through the intake pipe 12 into the interior of the purifying filter 1346. Pressure pump 28 is built into the intake pipe 12.

The solution present present in given case in the purifying materials and mixed for due time in the mixing autoclave 21 is fed through the combined attachment unit 4 into the purifying filter 1346. When materials crystallizing by cooling are treated, the cooling medium is conducted into the jacket space 1.13 of cup 1.12.

Under the pressure of the pressure pump 20 the solution passes through the connecting piece 4.5



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of the combined attachment unit 4 into the discharge pipe 13 as described earlier, and then into the collecting tank 23 of the washing liquid. Meanwhile the undesirable impurities settle on the surface of the filter fabric 6.8, from where they can be removed with washing liquid admitted under overpressure through the washing unit 3. Thus the filter fabric 6.8 can be cyclically regenerated.

The slurry collected in the branching space 4.6, or in the apparatus space 1.13 can be removed through the drain pipe connected to the low resistant stub 4.4 of the combined attachment unit 4.

The cake filtering apparatus 1346 shown in Figure 14 can be assembled from the same units as before. The material pressed by the pressure pump 28 is carried through intake pipe 12 from the autoclave mixer 21 to the reduced stub 4.3 of the combined attachment unit 4, and then into the branching space 4.6, then into the apparatus space 1.13.

If for instance crystalline suspension is discharged from the mixing autoclave 21, the crystalline material remains on the surface of



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the filter fabric 6.8, while the matrix passes through the connecting piece 4.5 into the collecting tank 24. The matrix residue between the crystal particles retained on the filter fabric 6.8 is removed with washing liquid derived from tank 22. This takes place in such a way, that the washing liquid arriving through the reduced stub 4.3 is pressed through the crystal layer, then the used up washing liquid is drained through the connecting piece 4.5 into the collecting tank 23.

The useful material retained on the filter fabric 6.8 is dissolved with washing liquid from the feeding tank 27, then it is carried along through the low resistant stub 4.4 into the suspension autoclave 26. The suspension autoclave 26 itself may be assembled from the basic apparatus 1 and mixing unit 2. Similarly the mixer autoclave 21 too can be assembled from the basic apparatus 1 and mixing unit 2.

Figure 15 demonstrates the crystallizing apparatus 1346 built up from the same units as earlier. Crystallization in the mixer apparatus 21 takes place under the influence of cooling.

However size of the crystals can not be regulated.

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Thus when the largest crystals approach the required size, then upon opening the shut-off device 13.1 of the discharge pipe 13, the crystal slurry is pressed with the pressure pump 28 through the reduced stub 4.3 into the apparatus space 1.13 of the crystallizing apparatus 1346.

During the process the already suitable crystals remain on the surface of the filter fabric 6.8, while the suspension and rest of the slurry are recirculated through the connecting piece 4.5 of the combined attachment unit 4. and drain pipe 14 into the mixer apparatus 21. By favourable selection of the pump capacity 28, it can be attained that crystals in excess of the acceptable size should not be formed.

The crystal particles settled on the surface of the filter fabric 6.8 are removed by actuation of the washing unit 3. This crystal slurry is removed from the crystallizing apparatus through the discharge pipe 11 fitted with low resistant stub and connected with the shut-off device 11.1.

The previously mentioned structural units are suitable for assembly of a drying apparatus 1346



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shown in Figure 16. The useful material is retained on the filter fabric 6.8 of the filter unit's 6 filter bag 6.2 by the method of cake filtering as already shown in Figure 14. Then the content is let off from the apparatus space 1.13 through the connecting piece 4.5, and the heating pipe 15 is connected to the intake stub 1.5 of dome cover 1.10. Drying gas is admitted into the apparatus space through the heating pipe with the heat exchanger 25. Under its influence the hot drying gas passes through the pores retained on the filter bags 6.2 and evaporates the humidity therefrom.

The wet gas is removed through the suction pipe 16 attached to the connecting piece 4.5 suitably with the aid of vacuum. After drying to the required degree, the shut-off device of the heating pipe 15 and that of the suction pipe 16 are closed, then the shut-off device 13.1 of the discharge pipe 13 connected to the low resistant stub 4.4 is opened.

Next the washing unit 3 will be capable to wash down the cakes retained on the filter bags 6.8 with the aid of the washing liquid flowing from the tank 22 through the pressure



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pump 28, and then the cakes are forwarded through the discharge pipe 13 into the mixing autoclave 21.

The adsorber apparatus 1346 shown in Figure 17 is built up from the former units. The adsorbent passing from the mixing autoclave 21 through the connecting pipe 7 is forwarded with pressure pump 26 to the reduced stub 4.3 of the combined attachment unit 4 and then into the apparatus space 1.13.

The solid particles of the adsorbent suspended in the mixing autoclave 21 cover the surface of the filter bags 6.2, while the suspension liquid can be discharged through the drain pipe 14 attached to the connecting piece 4.5 from the apparatus space 1.13. The liquid or gas to be adsorbed is admitted into the apparatus space 1.13 through pressure pipe 17 and similarly through the reduced stub 4.3. The liquid to be adsorbed passes through the adsorbent deposited on the filter bags 6.2 and it becomes fixed, while the other components pass off through the connecting piece 4.5 and drain pipe 14.

When the adsorbent layer is used up, inflow of the liquid through the pressure pipe 17



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is stopped, then washing liquid is admitted from the feeding tank 27 with pressure pump 28 into the washing unit 3 and by this the used up adsorbent is removed with the aid of the washing unit. This together with the washing liquid is discharged from the apparatus space 1.13 through the low resistant stub 4.4 and connected discharge pipe 13.

The multi-purpose chemical industrial apparatus according to the invention - as demonstrated above - is suitable for several chemical industrial processes. Its advantages are obvious mainly in the field of the pharmaceutical industry and organic chemical industry, where the production takes place mostly intermittently and with dosages of relatively small weight. In these industrial sectors highly valuable products are processed with highly valuable reagents and the qualitative requirements exceed the degree characteristic to the other sectors of the chemical industry. According to the experiences the multi-purpose apparatus is completely suitable to meet these high qualitative requirements.

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## WHAT WE CLAIM IS

1. Multi-purpose chemical industrial apparatus, particularly for carrying out the different processes of the pharmaceutical technologies, which has preferably a double-walled basic apparatus /1/ assembled from cup /1.12/ and attachable and openable dome cover /1.10/, the basic apparatus /1/ has a part for admission of the material to be processed, e.g. one or several intake stub/s/ /1.5/ arranged on the dome cover /1.10/, a part for discharge of the material, e.g. outlet stub /1.4/ arranged on the cup /1.12/ and in given case devices suitable for temperature variation of the material, characterized in that the basic apparatus /1/ is connected at least with one washing unit /3/ and filter unit /6/ and combined attachment unit /4/ connectible to the outlet stub /1.4/ of the cup /1.12/.

2. Apparatus as claimed in claim 1., characterized in that mixing unit /2/ is connected to the dome cover /1.10/ of the basic apparatus /1/.

3. Apparatus as claimed in claim 1., characterized in that the cup /1.12/ of the



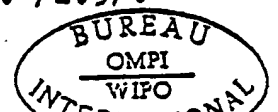
- 32 -

basic apparatus /1/ has heating stub /1.2/ connectible to heat source, e.g. heat exchanger, while the heating stub /1.2/ is led into the jacket space /1.3/ between the double wall of the cup /1.12/

4. Apparatus as claimed in any of claims 1 - 3., characterized in that the dome cover /1.10/ is seated on the cup /1.12/ along connecting flange /1.9/ and a lifting device /1.8/ with a coaxing hinge /1.7/ is built in between the cup /1.12/ and dome cover /1.10/ for lifting the said dome cover /1.10/.

5. Apparatus as claimed in any of claims 1 - 4., characterized in that the dome cover /1.10/ is provided with cover stub /1.1/ suitable for connection of the washing unit /3/ and in given case with manhole /1.11/ that allows reaching into and/or entering the apparatus space /1.13/.

6. Apparatus as claimed in claim 1., characterized in that the mixing unit /2/ includes a motor /2.4/-driven mixing shaft /2.5/ reaching into the apparatus space /1.13/, and mixing elements /2.1/ formed for instance as blades arranged at the shaft-end, furthermore driving gear /2.3/ and/or coupling /2.2/ are built in between the driving motor /2.4/ and mixing shaft /2.5/.



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7. Apparatus as claimed in claim 6., characterized in that the mixing unit /2/ is introduced into the apparatus space /1.13/ through the dome cover /1.10/ for instance through the cover stub /1.1/ or manhole /1.11/.

8. Apparatus as claimed in claim 1., characterized in that the washing unit /3/ includes a revolving gear /3.1/-driven washing shaft /3.3/ reaching into the apparatus space /1.13/ and at least one spray pipe /3.4/ arranged at the shaft-end.

9. Apparatus as claimed in claim 8, characterized in that the washing shaft /3.3/ passes through closed washing house /3.2/, while the washing house /3.2/ has a medium-intake stub /3.5/ for admitting the washing liquid and a supporting flange /3.7/ fixable to the dome cover /1.10/ preferably to its cover stub /1.1/.

10. Apparatus as claimed in claim 8. or 9., characterized in that the spray pipe /3.4/ is provided with nozzles /3.6/ conforming to the character of the washing liquid and exchangeable in given case.

11. Apparatus as claimed in claim 1., characterized in that the combined attachment



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unit /4/ includes branching piece /4.6/ fastened to the cup /1.12/ of the basic apparatus /1/ and a connecting piece /4.5/ passing through the branching piece /4.6/ and reaching into the apparatus space /1.13/.

12. Apparatus as claimed in claim 11., characterized in that the adjoining house /4.7/ has connecting devices of varying size suitable for admission and discharge of materials with different consistency, for instance one or several reduced stub/s/ /4.3/ or low resistant stub /4.4/.

13. Apparatus as claimed in claim 11 or 12., characterized in that the connecting flange /4.2/ is formed on the upper part of the branching piece /4.6/ for fastening to the discharge stub /1.4/ of the cup /1.12/

14. Apparatus as claimed in any of claims 11 - 13., characterized in that the upper end of the connecting piece /4.5/ is provided with devices arranged in the apparatus space, for instance with instant-connecting nest /4.1/ suitable for direct connection e.g. with filter unit /6/.

15. Apparatus as claimed in any of claims 11-14., characterized in that the combined



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attachment unit /4/ is complemented with one or several level adjusting extension/s/ /5/ suitable for extraction of material from the zones of varying height of the apparatus space /1.13/.

16. Apparatus as claimed in claim 15., characterized in that the level adjusting extension /5/ includes level adjusting tube /5.1/ and instant-connecting device /5.2/ arranged at the lower end of the level adjusting tube /5.1/ fitting into the instant-connecting nest /4.1/ of the connecting piece /4.5/.

17. Apparatus as claimed in claim 1., characterized in that the filter unit /6/ is assembled from series of filter bags /6.2/ with large surface arranged in filter basket /6.1/ while the filter bags /6.2/ are connected to collecting pipe /6.3/ underneath.

18. Apparatus as claimed in claim 17., characterized in that the filter bag /6.2/ is formed by flat plate encased in tubular frame /6.10/, which has preferably densely spaced network of channels /6.9/ on both sides leading into the tubular frame /6.10/, while the filter bag /6.2/ is covered with exchangeable



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filter fabric /6.8/ conforming to the character of the material to be filtered.

19. Apparatus as claimed in claim 17 or 18., characterized in that the lower part of each filter bag /6.2/ has connecting extension /6.6/ and the collecting pipe /6.3/ has receiving nests /6.7/ suitable for seating the connecting extensions /6.6/.

20. Apparatus as claimed in claim 19., characterized in that one or several filter bag/s/ /6.2/ is/are omitted, while the receiving nests /6.7/ at the place of the missing filter bags /6.2/ are closed with plug /6.11/ substituting the connecting extension /6.6/.

21. Apparatus as claimed in any of claims 17 - 20., characterized in that the collecting pipe /6.3/ is provided with instant-connecting devices /6.4/ for draining, fitted to the instant-connecting nest /4.1/ of the combined attachment unit /4/.

22. Apparatus as claimed in any of claims 17 - 21., characterized in that the supporting pieces /6.5/ are arranged on the outside of filter basket /6.1/ being in frictional contact with the internal wall of the cup /1.12/.

23. Apparatus as claimed in claim 1., characterized in that the mixer apparatus /12/ is assembled from the basic apparatus /1/ and



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mixing unit /2/.

24. Apparatus as claimed in claim 1., characterized in that the phase separator unit /45/ is assembled from the combined attachment unit /4/ and level adjusting extension /5/.

25. Apparatus as claimed in claims 23 and 24., characterized in that the solvent extracting apparatus /1245/ is assembled from the mixer apparatus /12/ and phase separator unit /45/.

26. Apparatus as claimed in claim 1., characterized in that emulsion separator apparatus /145/ is assembled from the basic apparatus /1/ and phase separator unit /45/.

27. Apparatus as claimed in claim 1., characterized in that gas washing apparatus /134/ is assembled from the basic apparatus /1/, washing unit /3/ and combined attachment unit /4/.

28. Apparatus as claimed in claim 1., characterized in that filter-washing apparatus /1346/ is assembled from the basic apparatus /1/ washing unit /3/, combined attachment unit /4/ and filter unit /6/.

29. Multi-purpose chemical industrial apparatus as claimed in claim 28., characterized in that gas filter, purifying filter, cake filter



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drying or adsorber apparatuses are assembled from the basic apparatus /1/, washing unit /3/, combined attachment unit /4/ and filter unit /6/ having in given case plug /6.11/ in place of one or several filter bag/s/ /6.2/.





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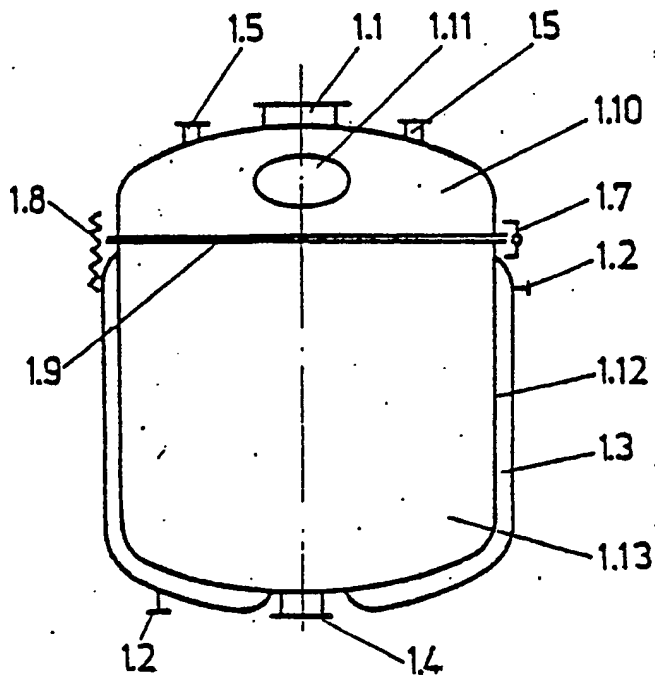


Fig. 1

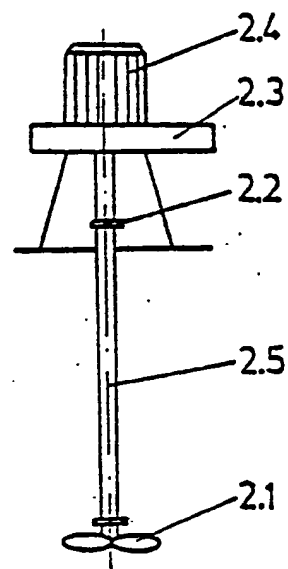


Fig. 2

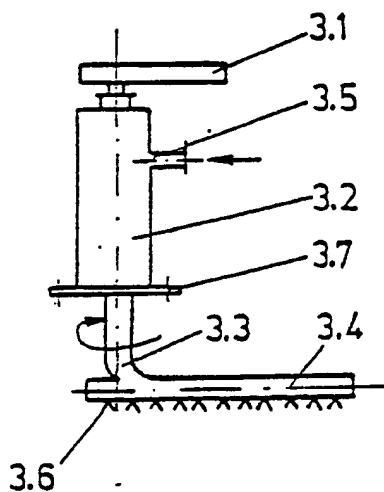


Fig. 3

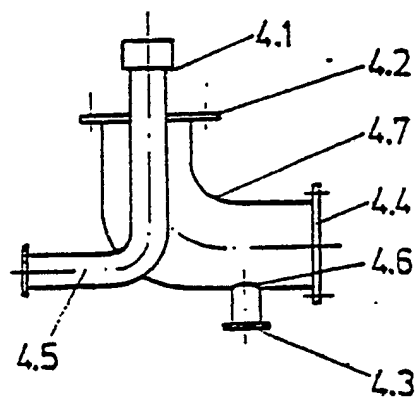


Fig. 4

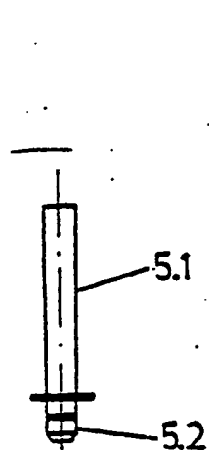


Fig. 5

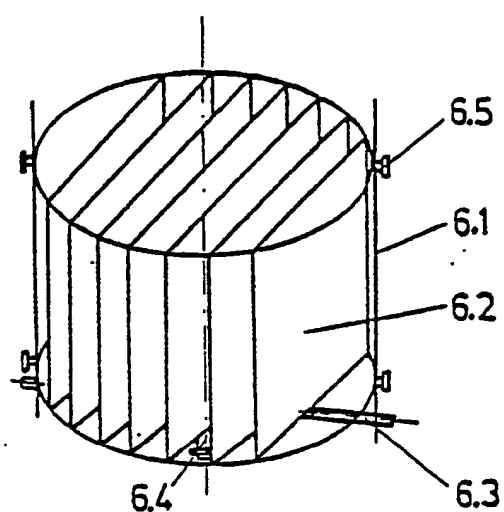


Fig. 6

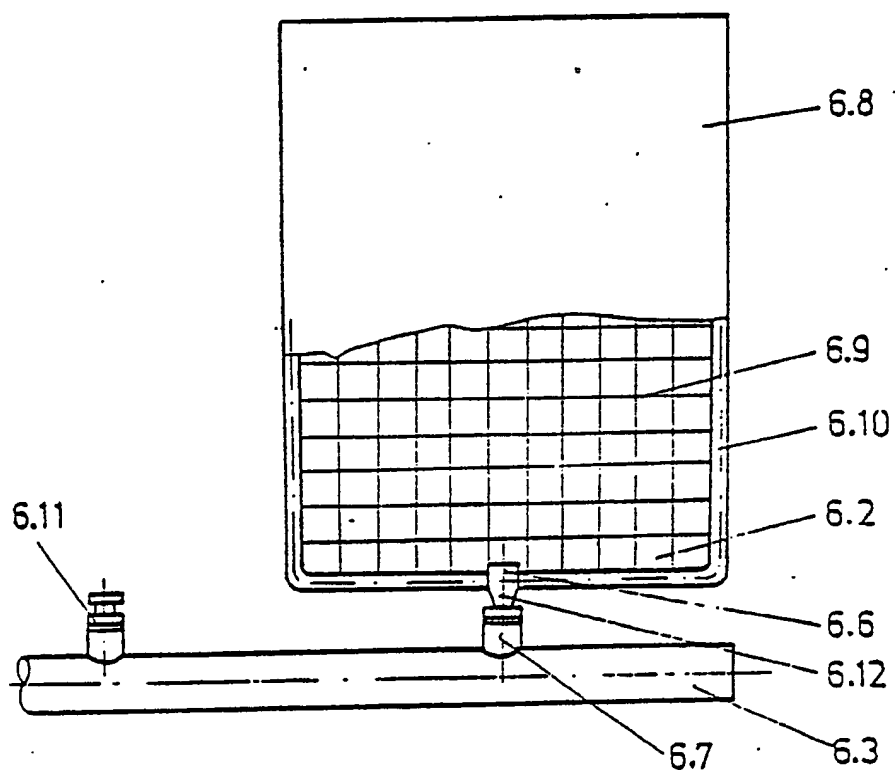


Fig. 7

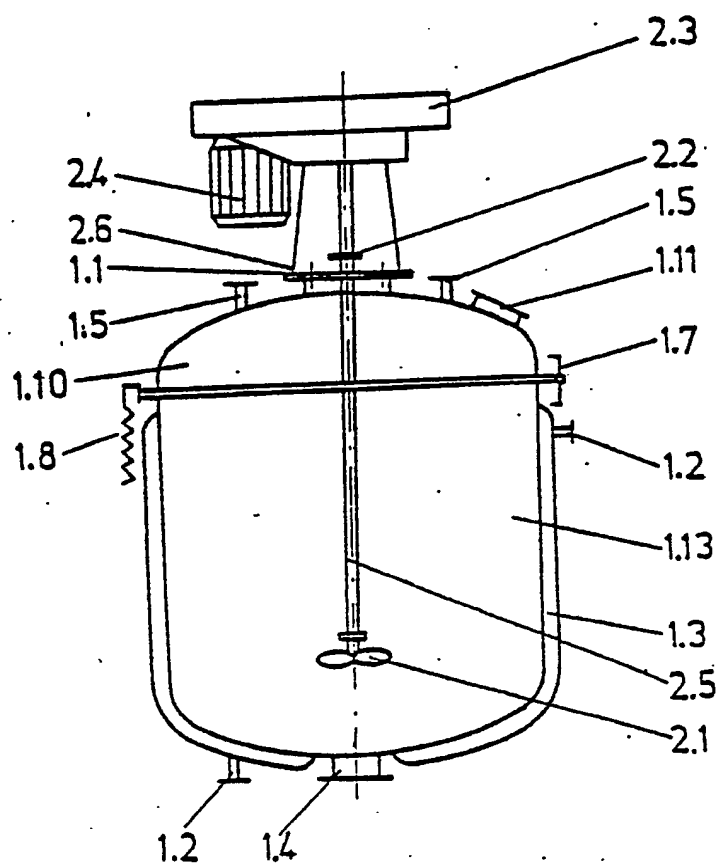


Fig. 8

4/12

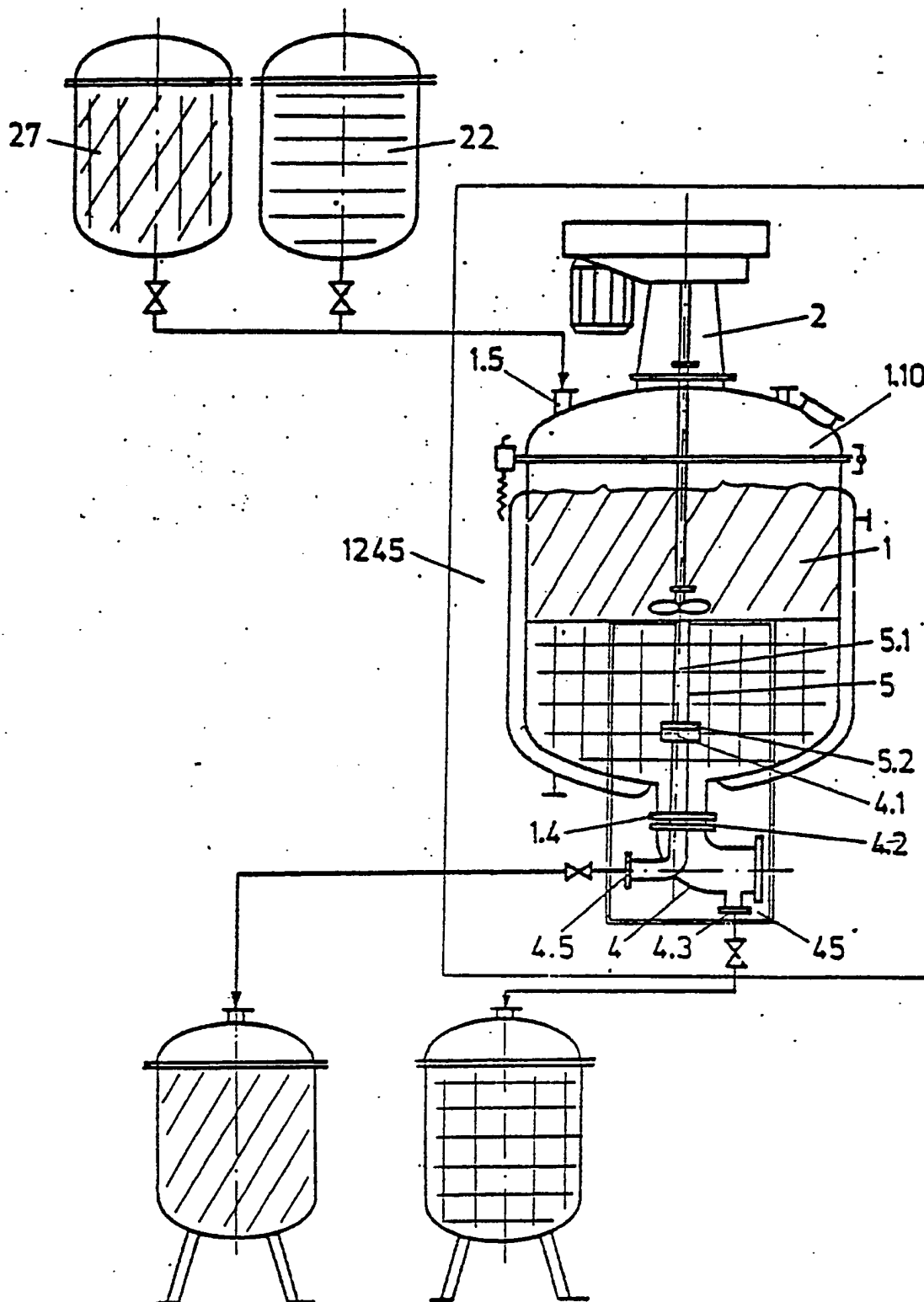


Fig. 9

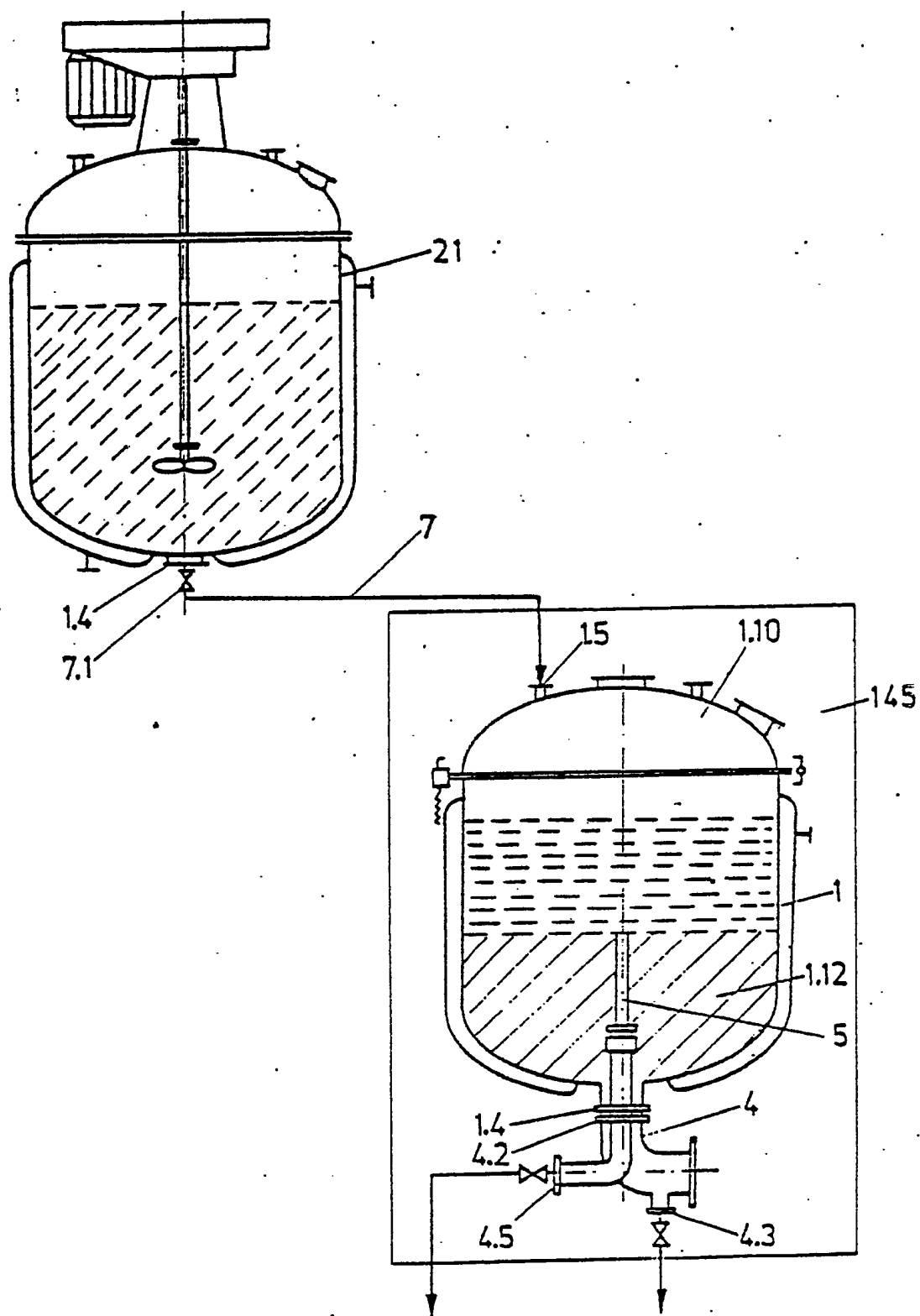


Fig. 10

6/12

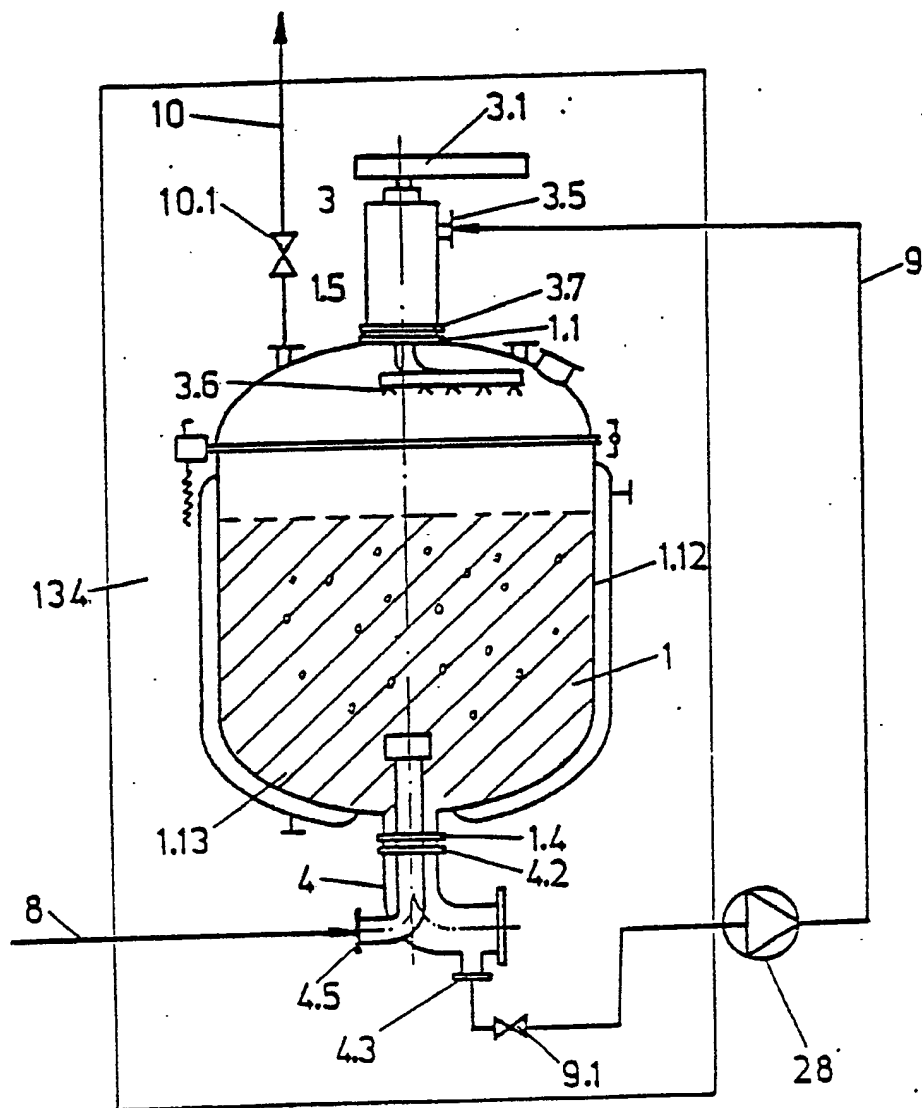


Fig.11

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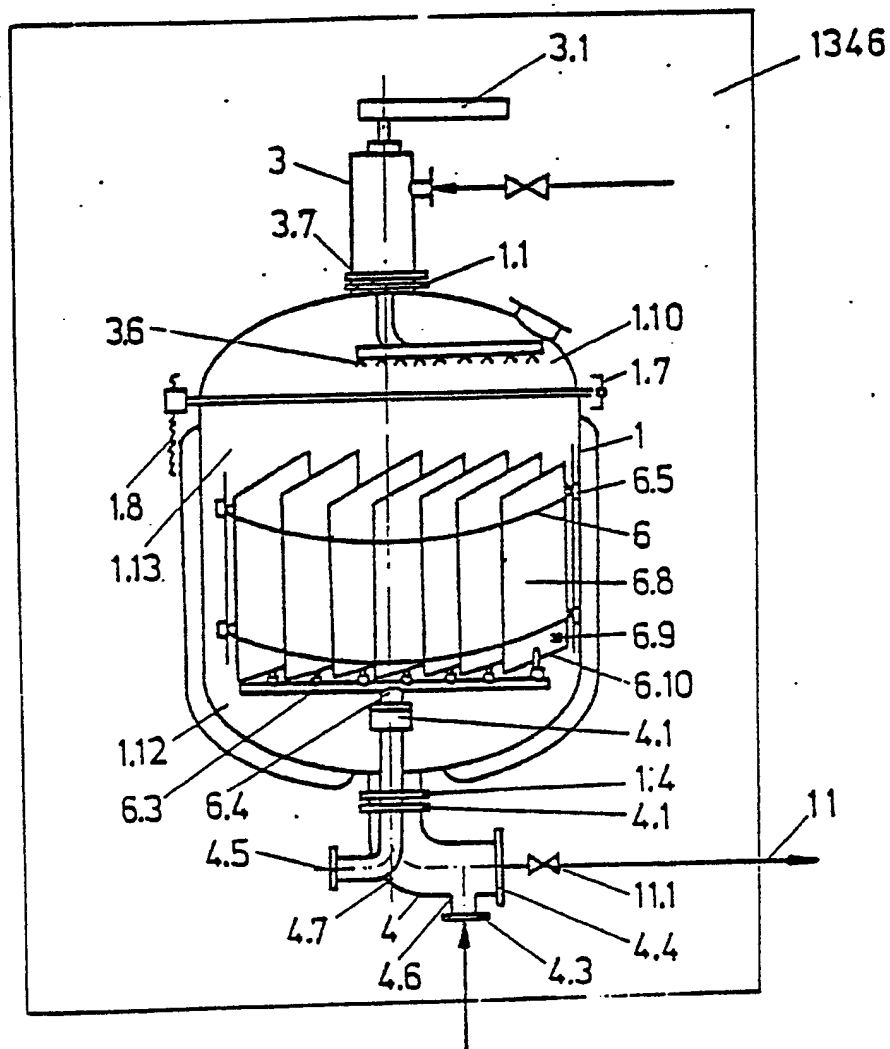


Fig. 12

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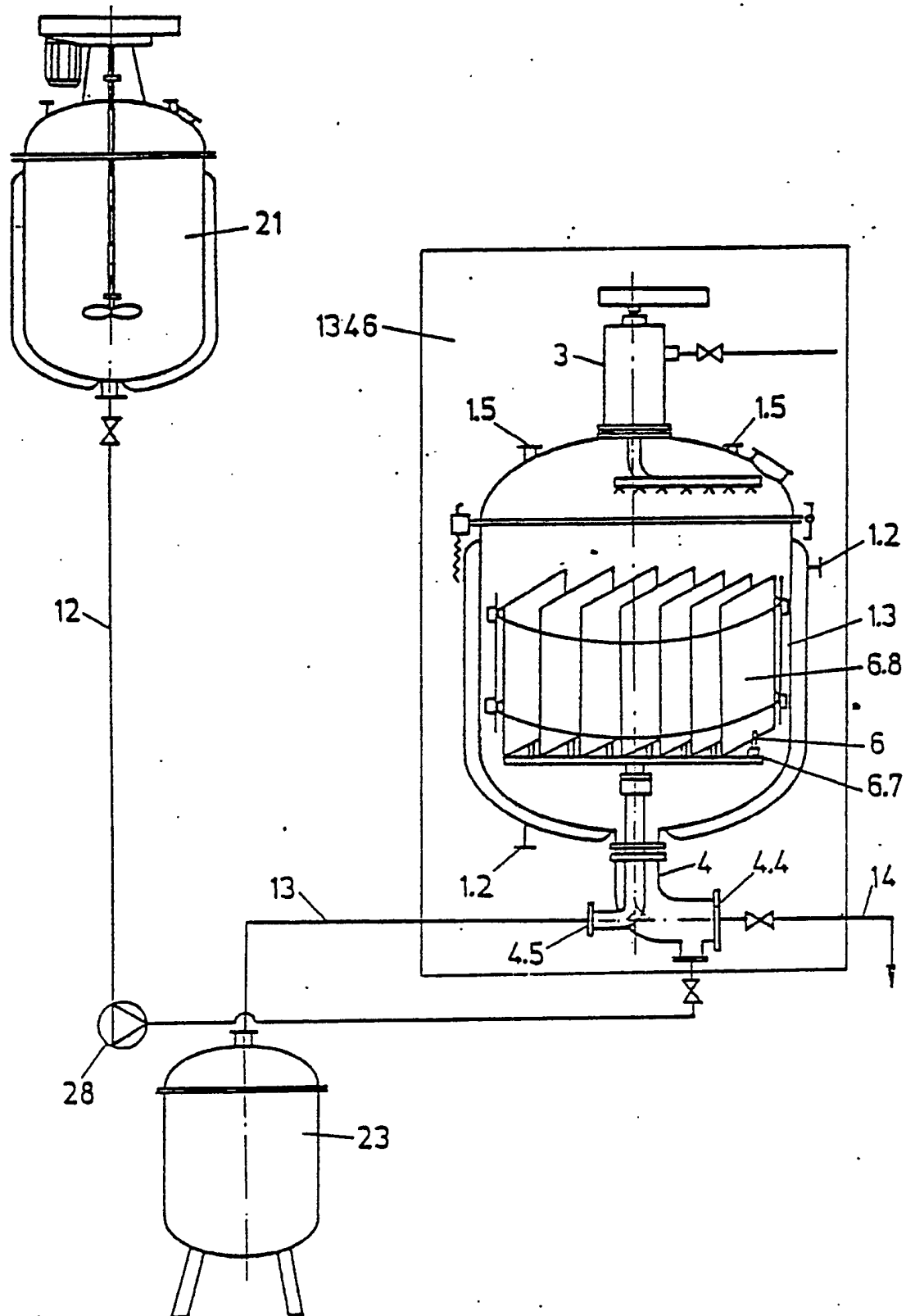


Fig. 13



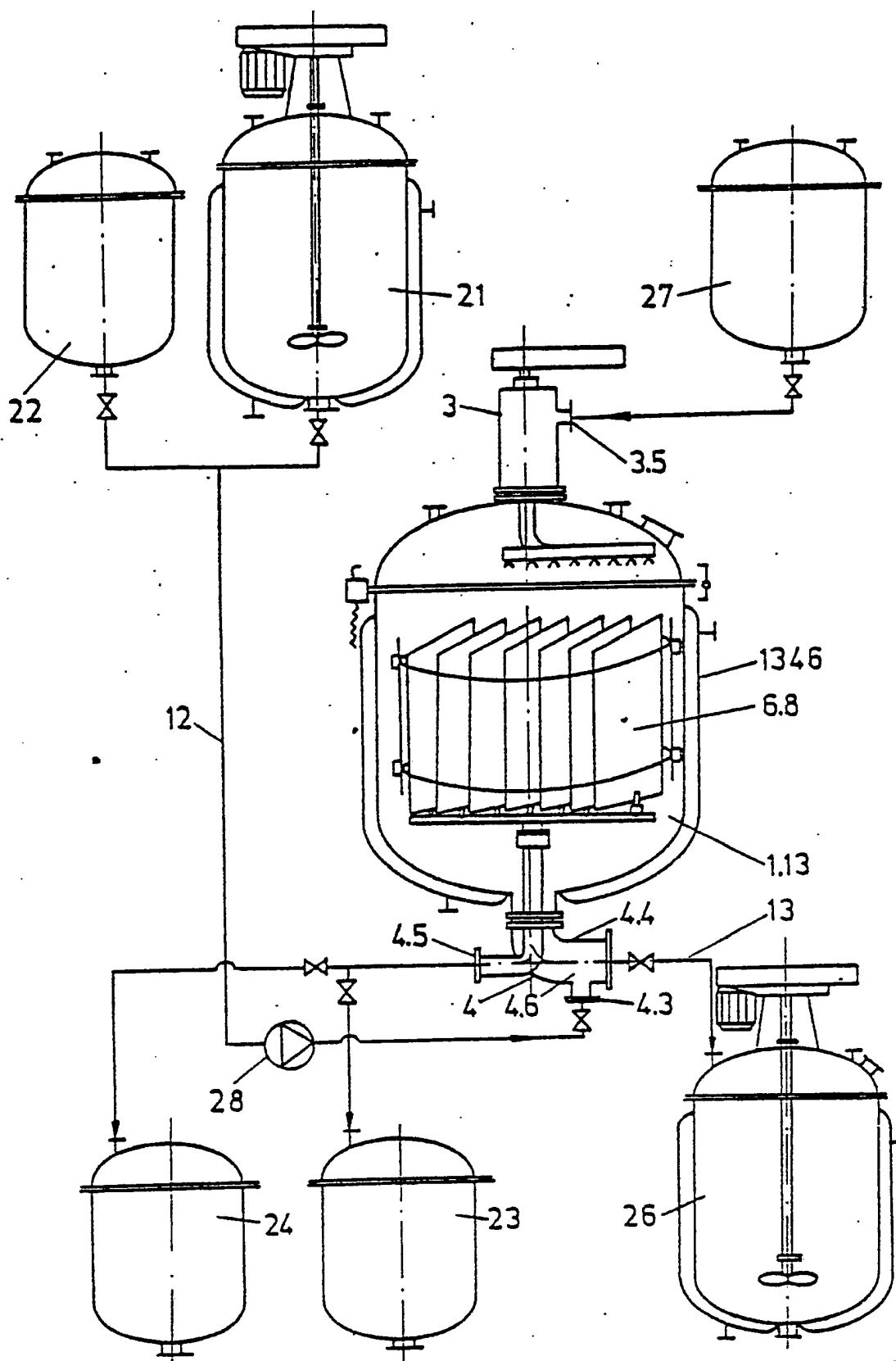


Fig. 14

10/12

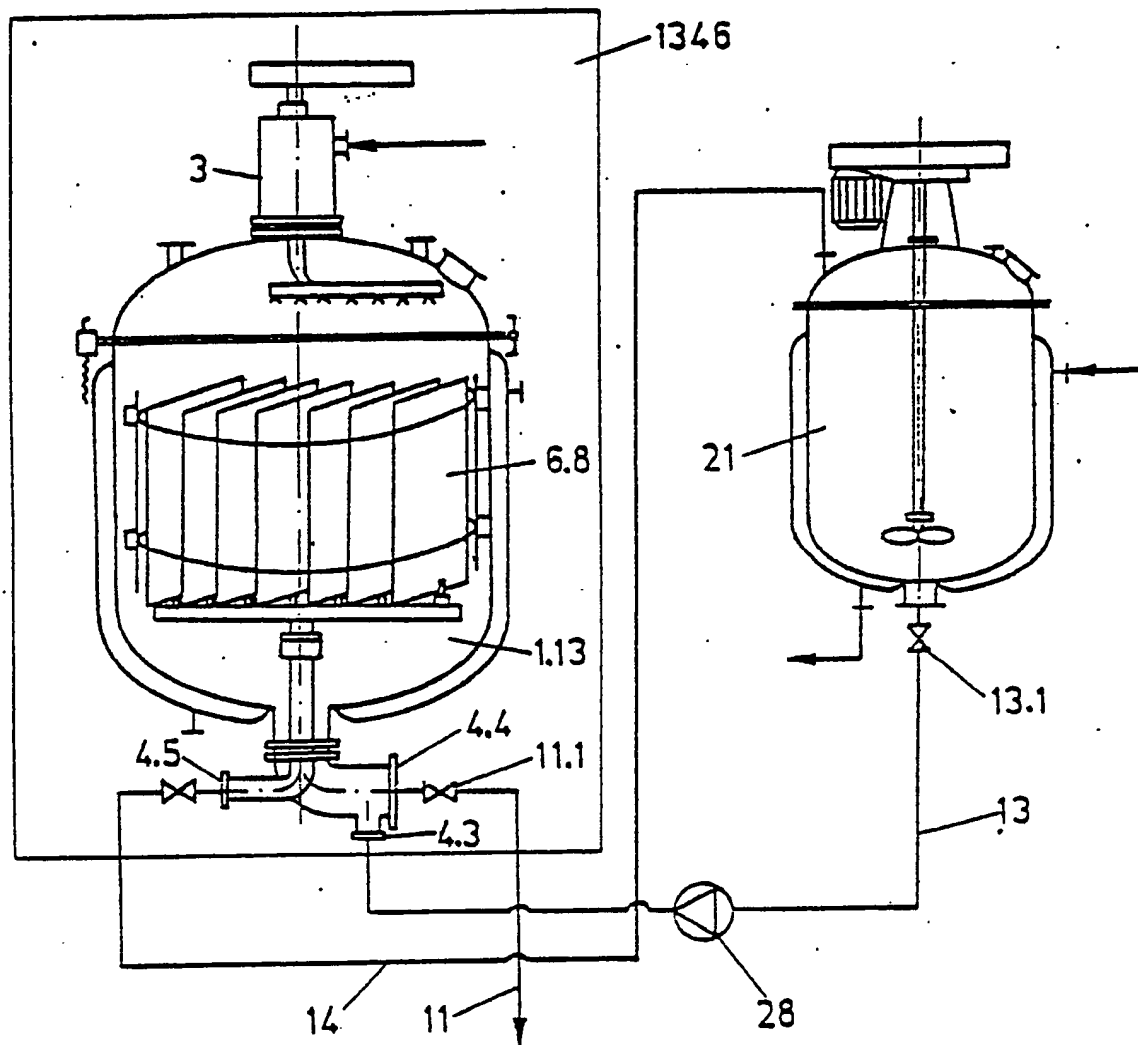


Fig. 15

11/12

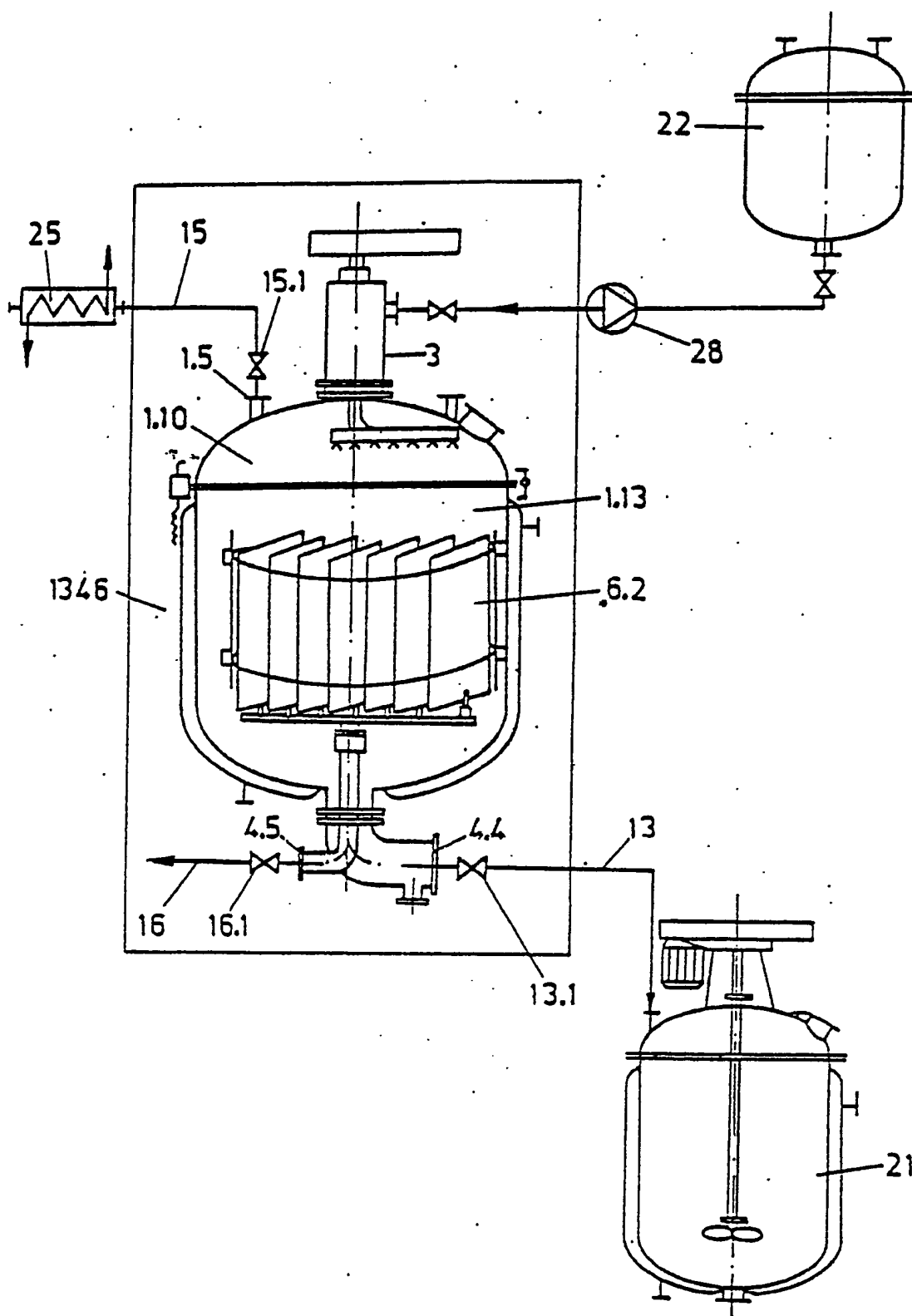


Fig.16

12/12

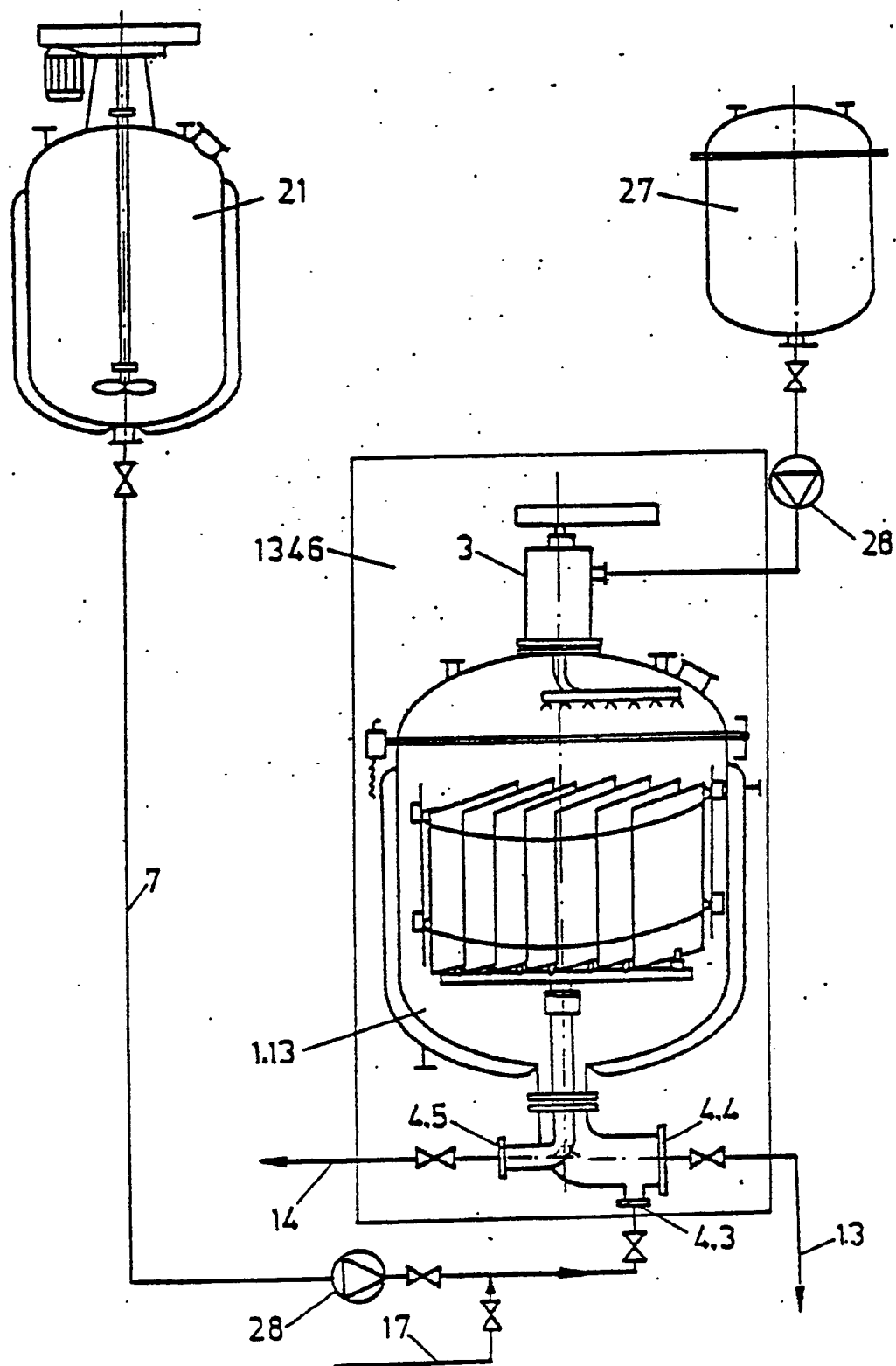


Fig. 17

# INTERNATIONAL SEARCH REPORT

International Application No PCT/HU81/00026

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>1</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <div style="text-align: center; font-size: 1.2em; margin-top: 10px;">B01J 19/00</div>																				
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; font-size: 0.8em; margin-top: 5px;">Minimum Documentation Searched <sup>4</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; border-bottom: 1px solid black; font-size: 0.8em;">Classification System <sup>2</sup></th> <th style="border-bottom: 1px solid black; font-size: 0.8em;">Classification Symbols</th> </tr> <tr> <td style="padding: 2px 5px;">IPC</td> <td style="padding: 2px 5px;">B01J 19/00</td> </tr> <tr> <td style="padding: 2px 5px;">IPC</td> <td style="padding: 2px 5px;">B01J 19/00</td> </tr> <tr> <td style="padding: 2px 5px;">DPC</td> <td style="padding: 2px 5px;">12g 4/01; 12g 4/02</td> </tr> <tr> <td style="padding: 2px 5px;">US</td> <td style="padding: 2px 5px;">127-1; 202-18; 202-184; 202-200; 202-204 .../...</td> </tr> </table> <div style="text-align: center; font-size: 0.7em; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched <sup>4</sup></div>			Classification System <sup>2</sup>	Classification Symbols	IPC	B01J 19/00	IPC	B01J 19/00	DPC	12g 4/01; 12g 4/02	US	127-1; 202-18; 202-184; 202-200; 202-204 .../...								
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US	127-1; 202-18; 202-184; 202-200; 202-204 .../...																			
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>14</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black; font-size: 0.8em;">Category <sup>5</sup></th> <th style="border-bottom: 1px solid black; font-size: 0.8em;">Citation of Document, <sup>14</sup> with indication, where appropriate, of the relevant passages <sup>17</sup></th> <th style="border-bottom: 1px solid black; font-size: 0.8em;">Relevant to Claim No. <sup>18</sup></th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">Y.A.Golovachevsky "Orositeli i forsunki skrubberov khimicheskoi promyshlennosti", published 1974, Publishing House "Mashinostroenie" (Moscow), see pages 188-189, drawings 66.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">8,9</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">Y.A.Golovachevsky "Orositeli i forsunki skrubberov khimicheskoi promyshlennosti", published 1974, Publishing House "Mashinostroenie" (Moscow), see pages 167-168, drawing 61</td> <td style="text-align: center; vertical-align: top; padding: 5px;">10</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">G.A.Akselrud, A.D.Molchanov "Gazozhidkostnye reaktory", published 1974, Publishing House "Khimiya" (Moscow), see pages 190-191, drawings IV.14</td> <td style="text-align: center; vertical-align: top; padding: 5px;">11,12,24,13 14,15</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">V.N.Sokolov, I.V.Domansky "Gazozhidkostnye reaktory", published 1976, Publishing House "Mashinostroenie", see page 12, drawing 4</td> <td style="text-align: center; vertical-align: top; padding: 5px;">2,3,23</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">A.N.Planovsky "Spetsialnaya apparatura promyshlennosti organicheskikh poluproduktov i krasitelei", published 1940, Publishing House "Goskhimizdat" (Moscow), see page 353, drawings 213,214</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,4</td> </tr> </table>			Category <sup>5</sup>	Citation of Document, <sup>14</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>	A	Y.A.Golovachevsky "Orositeli i forsunki skrubberov khimicheskoi promyshlennosti", published 1974, Publishing House "Mashinostroenie" (Moscow), see pages 188-189, drawings 66.	8,9	X	Y.A.Golovachevsky "Orositeli i forsunki skrubberov khimicheskoi promyshlennosti", published 1974, Publishing House "Mashinostroenie" (Moscow), see pages 167-168, drawing 61	10	A	G.A.Akselrud, A.D.Molchanov "Gazozhidkostnye reaktory", published 1974, Publishing House "Khimiya" (Moscow), see pages 190-191, drawings IV.14	11,12,24,13 14,15	X	V.N.Sokolov, I.V.Domansky "Gazozhidkostnye reaktory", published 1976, Publishing House "Mashinostroenie", see page 12, drawing 4	2,3,23	A	A.N.Planovsky "Spetsialnaya apparatura promyshlennosti organicheskikh poluproduktov i krasitelei", published 1940, Publishing House "Goskhimizdat" (Moscow), see page 353, drawings 213,214	1,4
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<div style="font-size: 0.8em;"> <sup>14</sup> Special categories of cited documents: <sup>16</sup>  <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> </div> <div style="width: 45%;"> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p> </div> </div> </div>																				
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of the Actual Completion of the International Search <sup>1</sup>  <div style="font-size: 1.1em; margin-top: 5px;">24 September 1981 (24.09.81)</div> </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of Mailing of this International Search Report <sup>1</sup>  <div style="font-size: 1.1em; margin-top: 5px;">26 October 1981 (26.10.81)</div> </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">           International Searching Authority <sup>1</sup>  <div style="text-align: center; font-size: 1.2em; margin-top: 10px;">ECLA/SU</div> </td> <td style="border-bottom: 1px solid black; padding: 5px;">           Signature of Authorized Officer <sup>18</sup>  <div style="text-align: center; margin-top: 10px;">               L. Komarova/           </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <sup>1</sup> <div style="font-size: 1.1em; margin-top: 5px;">24 September 1981 (24.09.81)</div>	Date of Mailing of this International Search Report <sup>1</sup> <div style="font-size: 1.1em; margin-top: 5px;">26 October 1981 (26.10.81)</div>	International Searching Authority <sup>1</sup> <div style="text-align: center; font-size: 1.2em; margin-top: 10px;">ECLA/SU</div>	Signature of Authorized Officer <sup>18</sup> <div style="text-align: center; margin-top: 10px;">               L. Komarova/           </div>														
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## FORTSETZUNG DER ANGABEN VOM ZWEITEN BLATT

III:		
A	Y.I.Makarov, A.E.Genkin "Tekhnologicheskoe oborudovanie khimicheskikh i neftepererabatyvajuschikh zavodov", published 1976, Publishing House "Mashinostroenie" (Moscow), see page 252, drawings 182, 183	6
X	Y.I.Makarov, A.E.Genkin "Tekhnologicheskoe oborudovanie khimicheskikh i neftepererabatyvajuschikh zavodov", published 1976, Publishing House "Mashinostroenie" (Moscow), see page 252, drawings 182, 183.	7
A	US, A, 2213907, published 03 September 1940, see drawing fig 2 B, H, Fleckenstein et al	5

V. ☐ BEMERKUNGEN ZU DEN ANSPRÜCHEN, DIE SICH ALS NICHT RECHERCHIERBAR ERWIESEN HABEN <sup>10</sup>

Dieser internationale Recherchenbericht geht gemäß Artikel 17 Absatz 2 Buchstabe a aus folgenden Gründen auf einige Ansprüche nicht ein:

- ☐ Ansprüche Nr. ...., weil sie sich auf Gebiete beziehen, in bezug auf die diese Behörde nicht zur Durchführung einer Recherche verpflichtet ist, nämlich:
- ☐ Ansprüche Nr. ...., weil sie sich auf Teile der internationalen Anmeldung beziehen, die den vorgeschriebenen Anforderungen so wenig entsprechen, daß eine sinnvolle Recherche nicht durchgeführt werden kann <sup>13)</sup>, insbesondere

VI. ☐ BEMERKUNGEN BEI MANGELNDER EINHEITLICHKEIT DER ERFINDUNG <sup>11)</sup>

Die Internationale Recherchenbehörde hat festgestellt, daß diese internationale Anmeldung mehrere Erfindungen enthält:

- ☐ Da der Anmelder alle erforderlichen zusätzlichen Recherchengebühren rechtzeitig entrichtet hat, erstreckt sich dieser internationale Recherchenbericht auf alle recherchierbaren Ansprüche der internationalen Anmeldung.
- ☐ Da der Anmelder nur einige der erforderlichen zusätzlichen Recherchengebühren rechtzeitig entrichtet hat, erstreckt sich dieser internationale Recherchenbericht nur auf die Ansprüche der internationalen Anmeldung, für die Gebühren gezahlt worden sind, also auf die folgenden Ansprüche:
- ☐ Der Anmelder hat die erforderlichen zusätzlichen Recherchengebühren nicht rechtzeitig entrichtet. Dieser internationale Recherchenbericht beschränkt sich daher auf die zuerst in den Ansprüchen erwähnte Erfindung; sie ist in folgenden Ansprüchen erfaßt:

Bemerkung hinsichtlich eines Widerspruchs

- ☐ Die zusätzlichen Gebühren wurden vom Anmelder unter Widerspruch gezahlt.
- ☐ Die Zahlung zusätzlicher Gebühren erfolgte ohne Widerspruch.

## FORTSETZUNG DER ANGABEN VOM ZWEITEN BLATT

II

GB

1(1)A; 1(1)F; B1F; B1X

FR

Gr V, Cl 3

CH

36g

AU

08.0; 28.3

CA

165

AT

12a; 12e 7

V. ☐ BEMERKUNGEN ZU DEN ANSPRÜCHEN, DIE SICH ALS NICHT RECHERCHIERBAR ERWIESEN HABEN <sup>10</sup>

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VI. ☐ BEMERKUNGEN BEI MANGELNDER EINHEITLICHKEIT DER ERFINDUNG <sup>11)</sup>

Die Internationale Recherchenbehörde hat festgestellt, daß diese internationale Anmeldung mehrere Erfindungen enthält:

1. ☐ Da der Anmelder alle erforderlichen zusätzlichen Recherchegebühren rechtzeitig entrichtet hat, erstreckt sich dieser internationale Recherchenbericht auf alle recherchierbaren Ansprüche der internationalen Anmeldung.
2. ☐ Da der Anmelder nur einige der erforderlichen zusätzlichen Recherchegebühren rechtzeitig entrichtet hat, erstreckt sich dieser internationale Recherchenbericht nur auf die Ansprüche der internationalen Anmeldung, für die Gebühren gezahlt worden sind, also auf die folgenden Ansprüche:
3. ☐ Der Anmelder hat die erforderlichen zusätzlichen Recherchegebühren nicht rechtzeitig entrichtet. Dieser internationale Recherchenbericht beschränkt sich daher auf die zuerst in den Ansprüchen erwähnte Erfindung; sie ist in folgenden Ansprüchen erfaßt:

Bemerkung hinsichtlich eines Widerspruchs

- ☐ Die zusätzlichen Gebühren wurden vom Anmelder unter Widerspruch gezahlt.
- ☐ Die Zahlung zusätzlicher Gebühren erfolgte ohne Widerspruch.

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